Both were most willingly given, in accordance with instructions sent by the Company by circular letter to the officers in charge of every station in the country. They had no plans and charts which they were not willing to publish, and which he believed were not already published. He might state that there was one pass which Captain Palliser and his party had not noticed. He had himself gone twice over the Rocky Mountains: the first time by a pass along the Peace River down to the head-waters of the Red River; and when he came back from Fort Vancouver he ascended Columbia River and crossed by the Athabasca portage. He slept on the top of fourteen feet of snow in the month of April.

The CHAIRMAN, in closing the discussion, said they had certainly always heard that the Company had more or less kept their maps to themselves.

MR. ARROWSMITH.—Not at all.

The CHAIRMAN.—Mr. Arrowsmith says "No," and he was sure, if all the knowledge they possessed of the geographical features of the country had been communicated to Mr. Arrowsmith, that that gentleman would have placed it before the world. There was a Dr. Thomson who had executed some remarkable maps of the country; and Mr. Ellice, a leading member of the Hudson Bay Company, had promised, if it were possible, that those maps should be brought to this country. He understood they were not attainable at once; but if they were, and the names applied by Dr. Thomson were to be realised, he had to announce that the mountain which had been named by Dr. Hector—"Mount Murchison"—would be converted into the "Devil Peak," *etc.* This came from geographical discoveries not being made public more rapidly.

ADDITIONAL NOTICES.

1. *On a Possible Passage to the North Pole.* By THOMAS HOPKINS, M.B.M.S.

AMONG the various attempts that have been made to approach the North Pole, that of Captain Parry may be considered as the most successful. It appears that he arrived at the latitude of 82° 43′ 32″, the point nearest to the Pole that has been visited by man, of which we have any knowledge. And it seems to be considered that there is but little probability of a more northern part being reached by the employment of any means at present known.

The difficulties encountered by Parry were certainly formidable, and there is not much likelihood of greater spirit or perseverance being displayed by future explorers than was exhibited by him and his companions. Yet it may be desirable that the nature of the impediments that were met with should be examined, in order to form an opinion respecting the possibility of future navigators being more successful than their predecessors. The climatic features of that part of the world in which the effort was made are so extraordinary as to leave room to doubt whether past experience in other parts, in high northern latitudes, presents the means of forming decided opinions respecting what kind of weather may be found adjacent to the longitudes visited by Parry. The facts which he furnishes deserve close examination and careful analysis, in order to ascertain whether they present to view obstacles that must be deemed insurmountable, and, if not, what are the best means to be used in making a new attempt to overcome them?

A general view of the temperature of the atmosphere in this part may be

obtained by an inspection of the charts published by Dove, showing the isothermal lines of the temperature over that portion of the ocean which lies between Greenland and Northern Europe. From these lines it appears that, in the winter, heat is borne farther north in this locality than in any other part of the Arctic regions. The longitudes distinguished for superior winter warmth extend from the meridian of Greenwich to 60° E. of it. Within this range the line of average temperature of 32° in the month of January advances from the latitude of 68° to that of 70°, which it reaches in the fifth degree of east longitude from Greenwich. At the same time the low isothermal line of 5° of temperature is found, in the latitude of 78°, extending from the meridian of Greenwich to the longitude of 40° E., the two temperatures reaching higher latitudes within the meridians named than on any others. These are winter temperatures which will be admitted to be extraordinary, and they evidently must be produced by some powerful cause.

In July the isothermal of 36° of temperature is in about 67° of latitude in the northern part of America, and, proceeding eastward, it rises to 82° of latitude near Spitzbergen, and then sinks to 69° of latitude over the land in the north of Europe, giving a march of the same degree of temperature in this part of the world through 15° of latitude. The isothermals, in the other portions of the year, have the same general character as in the two seasons of winter and summer, being intermediate between the extremes; the greatest range of temperature being in the winter, and the least in the summer. This indicates that the local warming influence is the most powerful in winter, when the sun is absent, and that, as direct solar heat increases, the local is partially concealed by the general influence. But the local cause of the rise of the isothermals to more northern latitudes, whatever that cause may be, retains much power in the summer, as is shown by the ascent of those lines at that season. Both the local and the general warming influence tend, therefore, to convert the ice of the Arctic Ocean into water in this particular locality.

The dynamic force of the Mexican Gulf-stream is sometimes said to be the cause of the high winter temperature of this part. If that opinion were well founded we might reasonably expect that the ocean-stream from the Atlantic would have influence in summer as well as in winter, as the warm water would be more likely to retain its heat in the former than in the latter season. But if, as has been shown, there is good reason to believe that the high temperature of this part is attributable to condensation of atmospheric vapour, which is brought from more southern parts by wind, we may inquire whether we are not authorised to infer that the same process is continued in the parts nearer to the Pole that are yet unexplored. Captain Parry, in his voyage towards the Pole, proceeded to Spitzbergen, and took his departure from that island in latitude 80° and longitude 21° E., on the 23rd day of June. The following are extracts from his account of his voyage, and they show what kind of weather he found on the meridian along which he proceeded:—"We were a good deal surprised on landing in Mussal Bay, latitude 80°, to find that large streams of water were running down all the hills, and that there were large ponds of it in every direction, a circumstance the less expected by us, since we had never seen it half so abundant in any of our winter stations at this season, not even at Winter Island, which lies in latitude 66¼°, or nearly 14° to the southward of this." "Ever since we had got into open water we had scarcely once seen the blue sky; and for ten hours out of every twelve, we had experienced fog, sleet, or snow" (p. 141). "On the 23rd we set off in our boats, the sea being smooth, taking leave of the Spitzbergen shores. The weather soon after became very thick, with continued snow. The temperature, while we slept in the day, was usually from 36° to 45°. It came on to rain very hard on the morning of the 26th. It is a remarkable fact that we

had already experienced, in the course of this summer, more rain than during the whole of seven previous summers taken together, although passed in latitudes from 7° to 15° lower than this! We were now in latitude 81° 23′ and in longitude 21° 32′ 34″ E. We now enjoyed the first sunshine since our entering the ice. On the 2nd July the weather was calm. The temperature at noon was 35° in the shade and 47° in the sun. The weather became gradually inclement, and thick with snow and sleet. The snow-storm changed to heavy rain, and the wind increased to a fresh gale. We halted at 6 on the 8th, in time to avoid a deal of rain. On the 9th we enjoyed the indescribable comfort of two or three hours' clear dry weather, but at 5 A.M. it again came on to rain, which continued most of the day, but was succeeded by one of the thickest fogs I ever saw. There was not much dryness in the atmosphere when the sky was clear, the dew-point by Daniel's hygrometer being 35° at noon, when the temperature of the atmosphere was the same. Lat. 82° 14′ 28″, long. 22° 4′ E. The temperature of the surface-water was 32½°, the air being 36°. It rained hard and incessantly. I had never before seen any rain in the Polar regions to be compared with this, which continued without intermission for 21 hours; sometimes falling with great violence, and in large drops, especially about 2 A.M. on the 15th July. It held up a little at 5, and at 6 we set out, but the rain soon recommenced. At 8 the rain again became heavier, and at 10 we were obliged to halt, the rain coming down in torrents. The wind shifted to W.S.W. in the afternoon, and the rain was succeeded by a thick fog, after it had been falling for 30 hours out of the last 31. At midnight on the 22nd July, we had a good observation in lat. 82° 43′ 32″; the long. 19° 52′ E. The wind had been much from the south; on the 20th a north wind arose. The meridian over which we passed was found warmer and wetter than Phipps found it. It would probably have been no difficult matter to reach the parallel of 83° in our ships about the meridian of the Seven Islands."—p. 256.

In this laborious effort to approach the Pole nothing appears to have surprised the adventurous voyagers so much as the large quantity of rain that continued to fall. But there is good reason for presuming that to this rain they might have attributed the degree of warmth which they experienced. Moist air, coming from the south, would soon have some of its vapour condensed by the cold of the latitude; and this condensation being continued by successive supplies of southern vapours, would produce ascending atmospheric currents and rain, of a temperature that would be determined by the quantity of heat given out in the lower regions by the condensing vapour. The rain would be the principal agent in thawing the ice that had been accumulated during the winter; the remaining portion of the ice, as it thawed, preventing the temperature of the sea from rising much above 32°. Supposing this view to be substantially correct, it will follow that, to the flow of much atmospheric vapour from the south, we have to attribute not only the comparatively high temperature of the locality, but also the thawing of the ice, and the opening of a navigable sea. The possibility, therefore, of penetrating farther into the Arctic Ocean, and approaching the Pole, appears to depend upon the continuance of an adequate supply of vapour from warmer latitudes.

In examining the lines on Dove's charts, in this part of the Arctic Ocean, we are struck with the advance of warmth at all times of the year, far towards the east as well as the north. It is sufficiently apparent that some cause takes atmospheric heat northward from, say about Iceland, towards the meridian of Nova Zembla. The central portion of this warm aërial current appears to pass somewhere between the North Cape and Spitzbergen, in about a north-eastern direction.

Supposing it to continue in the same course it would approach the Pole,

say between the meridians of 40° and 60° E. Towards this part moist south-west winds do actually pass freely from the Northern Atlantic; and it may be presumed, from what is known to take place in other parts of the world, that these winds produce the high temperature of the parts pointed out.

But some special cause must exist capable of determining the wind to blow towards this locality; and, in the absence of positive information on the subject, yet in accordance with what has been proved to take place in many parts, we may infer that this cause is the existence of an elevated ridge of land near to the Pole! In every part of the world, where winds blow with a certain degree of permanence, it has been shown that there is elevated land at their termini, against which land atmospheric vapour is condensed, producing in the parts ascending currents. These currents are generally constituted of air which has been brought from a distance over the sea; and the Arctic Ocean between the most northern part of the continent of Europe and the islands of Iceland and Spitzbergen is the part over which air would be likely to pass to such high lands. The mountains of Spitzbergen rise to a height of from 3000 to 4000 feet, and those of Nova Zembla are represented to be of about the same height. The latter appear to be a continuation of the Ural Mountains, which are near the meridian of 60° E. The south-west winds of these parts furnish presumptive evidence that land exists farther north; as no other reasonable cause of these winds can be found, and analogy warrants the inference that high land, in the locality pointed out, is the cause. It may be an extension of that which rises so much above the ocean level in Nova Zembla, or it may be a continuation of North-East Cape. Lines of elevation are generally continuous, and though they may sink below the ocean in one place, they may, at a considerable distance, rise above it, to a sufficient height to condense vapour that is brought in a moist atmosphere. Such elevated land may, therefore, through the agency of condensing vapour, be presumed to be the cause of the superior warmth that is found penetrating far into the Arctic regions in this part of the world.

We presume then that condensation of aqueous vapour is the cause of the summer temperature in this part being higher than it is in other parts of the Arctic Ocean of the same latitudes; as then the liberated heat of vapour is added to the direct solar heat to constitute the actual temperature. The sun remains above the horizon in that season, but it does not ascend higher in the heavens, and therefore the direct heat is not powerful to raise the temperature. The accumulated ice of winter, when converted into water in the summer, absorbs much heat, and makes it latent—tending to keep the temperature from rising above 32°. It requires, therefore, the heat of vapour to be added to the direct solar heat to warm the part to the extent that is experienced.

A continuous supply of vapour is, however, necessary to produce the prevalent wind; but that wind may not only contribute towards the melting of the ice, and making an open sea, but may materially assist navigators in making their way towards the supposed high land, and possibly to the Pole. The Russians are, no doubt, in possession of much information respecting the summer temperature, near the North-East Cape, in latitude 78°, but I am not aware of its nature. The prevailing land-winds in this part, both in winter and summer, are said to blow from the Polar Sea over the land of Eastern Europe, and the air in them may be supplied from an ascending current in the neighbourhood of the Pole. Large portions of the atmosphere seem to pass over the Northern Atlantic and Arctic Oceans to high northern latitudes, and towards the longitude 60° E., from which they appear to return to the great areas of condensation that are situated southward, thus forming parts of a system of aërial circulation, which, with some irregularity, passes over Europe towards the West Indies, and returns by the Atlantic to the Pole.

Of the island of Nova Zembla we have but few accounts from recent voyagers. Barentz visited it, and from what he says it may be presumed to resemble Spitzbergen in the warmth of its summer climate.

When Captain Parry left Spitzbergen he proceeded directly northward; and we have seen that he encountered much rain, with occasionally a high temperature for the latitude. It seems also that he might have proceeded farther on the same meridian, notwithstanding the obstacles to his progress presented by the ice, had he not encountered an adverse oceanic current. This current is described by him as setting southward, that is, it was running from the Pole! Now a current of water could not flow from the part about the Pole, along the meridian of 20° E., on which Parry was proceeding, unless some other current was running towards the Pole, over some other meridian. It has been shown that in all primary currents of the ocean, wind presses on the surface of the water, and forces it forward until it is stopped by some barrier. The water is then raised above its natural level, and may possibly return as a secondary current passing through some channel, or as an under-current; or, the water, having been forced forward in an open sea in one direction, may meet with another current and be bent from its course, as is found to be the case in many parts of the ocean. The current encountered by Parry, when he was near the latitude of 83°, may therefore have been a return current flowing from the Pole.

Malte-Brun says, "The polar currents of the north exhibit very remarkable effects. These currents are particularly observed in the Northern Frozen Ocean, on the coasts of Greenland and Iceland, and in Bering Strait, they have usually a direction from north to south, occasionally the reverse. In Bering Strait the current which brings the ice from the Polar Sea to the neighbourhood of Kamschatka is distinctly felt" (p. 341). Now it is not possible that water could continue to flow from the Northern Frozen Ocean unless some other current flowed into it. And the various facts within our knowledge, some of which have been given, point towards the part named as the line or stripe which this current traverses in flowing towards the Pole. An oceanic as well as an atmospheric current passing over the Arctic Ocean from the south-west, near Nova Zembla, might go eastward across the Polar Sea, and to that part of it which is north of America. Or the water having been forced towards and accumulated near to, or about the supposed high land near the Pole, might, by statical pressure, be afterwards impelled towards Bering Strait, Barrow Strait, and even to the east coast of Greenland; just as the water in the Gulf of Mexico, by its elevation, forces the rapid Gulf-stream through the Straits of Florida to the Azores. The existence of a current flowing from the north through Bering Strait, and another from Baffin Bay to the Atlantic, raises a presumption that there is a stream from the south forced into some part of the Arctic Ocean; and in no other part does it appear so likely to be found as between the islands of Spitzbergen and Nova Zembla. Supposing this sea to be open in the summer, it would not require a strong southern current to furnish the water that may pass by the Pole and out by Bering Strait and Baffin Bay, seeing that neither of the two latter is strong, and that, on the east side of Greenland, it appears to be so feeble as to be detected only by the presence of bodies that have floated to its shores. Malte-Brun attributes the currents from the north to the melting of snow and ice; but this is so inadequate a cause, that it perhaps would not have been thought of, if any other probable cause could be found.

Dr. Kane, in his account of his northern voyage on the western side of Greenland, represents that his exploration was continued up to the 12th July, and he observes that "Greenland has been traced to its northern face. A glacier runs nearly due north, and cements together the continent masses of Greenland and America. The northern land into which this glacier merges

has been named Washington; and the bay which interposes between it and Greenland I have named after Mr. Peabody. This bay gives exit at its western curve (latitude 80° 12′) to a large channel. This channel expands to the northward into an open and iceless area, abounding in animal life, and presenting every character of an *open Polar Sea*. A surface of 3000 square miles was seen at various elevations, free from ice, with a northern horizon equally free. A north wind, 52 hours in duration, failed to bring any drift into this area!"—*Kane's Official Report.*

Captain Parry, when near latitude 83°, discovered that a current of water setting to the south was strong enough to prevent his proceeding farther towards the north, and defeated the main object of his voyage. Now the water thus found, we have seen reason to believe, may have been a return current of water, which had previously been forced above its natural level by a wind blowing over some other meridian from the south. The part near Nova Zembla, already described, is the only one where such a wind is found; in that part, therefore, it may be presumed that a southern oceanic current exists.

It may be thought that the evidence which has been brought forward is not sufficient to warrant the belief that such a stream as that alluded to, flowing from the south, is in existence; but candid inquirers will admit that analogy gives strong countenance to the belief. Over every part of the ocean, where a decided wind blows, it puts in motion the water, and produces a current proportioned to the strength and continuance of the wind. The great permanent trade-winds create oceanic currents, as do also the monsoons or season-winds during their period of action. Tropical west winds blow towards the great East Indian Archipelago, the coasts of Guinea and Panama, and western oceanic currents attend them. When winds blow over the ocean a current of water is always found to follow them, of a strength proportioned to the strength of the wind, and the constancy of this association is evidence of the connexion that exists between them. In the Northern Atlantic wind blows from the south-west into the Arctic Ocean, and water goes with it, as far as has been traced, from warmer to cooler latitudes. In the southern hemisphere a wind blows from Victoria Land across the Southern Ocean, to Tierra del Fuego, and it creates a current sufficiently strong to impel water towards the Western American coast, which, when helped forward by another wind, takes it near to the Equator. On the eastern side of South America, along the coast of Brazil, a current runs from about the 8th to the 50th degree of south latitude, and this is in the opposite direction to the current that is found on the western side; but both are put in motion by winds. Analogy therefore authorises us to believe that the south-west winds, which prevail between Iceland and Norway, and which blow in the Arctic Ocean between Spitzbergen and Nova Zembla, take with them a current of warm water; and we may infer that the water and the warm moist air will have influence on the climate and general state of the Arctic Ocean.

We may then draw the general conclusion, that to the east of Spitzbergen there probably is, in the summer of the northern hemisphere, an open sea extending towards the North Pole, which may possibly be navigated by a ship that has been properly prepared for the voyage. The particular line over which the prevalent southern wind generally passes in the summer, may be ascertained from persons the most capable of giving information on the subject; and along the line navigators might proceed towards the Pole at the proper season. The kind of ship best suited for the purpose would, of course, be determined by those most competent to decide on the point, but it is to be presumed that steam would be used to propel it.

From the latitude of 83°, which has been already approached, to the Pole, is only 7°, or 420 miles; and if no serious obstruction were encountered, this

distance might be passed over in a very few days. Floating ice seems to be the impediment most likely to be met with, but a screw-propelled ship might be able to make way through it, without much danger of sustaining damage, and in this way the Pole might possibly be reached.

Persons familiar with Arctic navigation would have the benefit of local knowledge, though possibly such knowledge may hardly justify such an attempt. This paper has been suggested by observations of continuous winds in many parts of the world, of their places of termination, and the climates of those places. The south-west monsoon, blowing towards the Himálaya Mountains, readily takes a ship into the Bay of Bengal, and the trade-winds waft vessels across both the Atlantic and Pacific Oceans. A wind blows from Victoria Land, in the Antarctic Ocean, to the mountains about Cape Horn, which are warm in the winter, evidently because vapour is condensed there in great abundance; and the wind is the strongest when it approaches the locality of condensation. If, as is very probable, there be similar elevated land near the North Pole, it is likely that a ship might reach that land with greater ease than when passing from Victoria Land to Cape Horn.

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2. *Surveys in Norway.* By Professor HOLST, Christiania. Translated from the Norwegian by DR. SHAW.

IN the Budget of the Norwegian Diet is found an article on the progress of the Geographical Survey of that country, from its beginning to the year 1859, accompanied by a review of the results attained; which statements will be of interest to many more than to those few into whose hands a copy of the Government's treatise may fall, and which therefore is communicated here.

The Survey was founded in the year 1779 by General Huth, Chief of the Danish and Norwegian Engineer and Artillery Corps, and in that year the officers appointed to the task, Lieuts. D. Vibe and Rick, after having received the necessary instructions, repaired to Norway. A base was measured during the winter on the ice of the Miös, on which the trigonometrical net was constructed, and later, on the ice of the Lakes of Fœmund, Storsöe, and other lakes. Astronomical observations were likewise made by the above-mentioned officers. While these were employed from 1780 to 1790 on the survey of the kingdom, especially along the frontier districts, it was resolved that a Hydrographic Survey should, at the same time, be carried on, in order to obtain exact charts of the southern coasts. For this task Lieut. Growe of the Royal Navy and Lieuts. N. Vibe and Aubert were selected. This survey was commenced in 1788 and concluded in 1799. The result was 7 engraved charts of the tract between Drontheimsled and Idefiord, with descriptions of the coast and of the country around. At that time the survey was placed under the Revenue Board of Denmark, and the King, as proprietor of Laurvig, in the year 1807 commanded that very special charts should be taken of this district also. Besides this, the surveys were continued in the districts of Drontheim and Hedemark and along the frontier of the kingdom, and executed on a large scale; it being thought necessary to have very special maps of those districts in which the contests between Norway and Sweden had generally taken place. The surveys were, however, often delayed, partly from want of means, especially during the last war. After the union of Norway with Sweden the task was placed under the Department of Finance, Commerce, and Customs, and afterwards under that of the Home Department. When, in 1826, so much of the east and south of the country had been specially measured, that maps of the districts could be made, Captains Munthe and Ramm undertook this task, as a *private* enterprise; and six maps, comprising the districts of